AOIT Computer Networking

Lesson 6

Network Topologies

Teacher Resources

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| Resource | Description |
| Teacher Resource 6.1 | Presentation and Notes: Types of Network Topologies (includes separate PowerPoint file) |
| Teacher Resource 6.2 | Assessment Criteria: Presentation on Network Topologies |
| Teacher Resource 6.3 | Key Vocabulary: Network Topologies |
| Teacher Resource 6.4 | Bibliography: Network Topologies |

Teacher Resource 6.1

Presentation Notes: Types of Network Topologies

Before you show this presentation, use the text accompanying each slide to develop presentation notes. Writing the notes yourself enables you to approach the subject matter in a way that is comfortable to you and engaging for your students. Make this presentation as interactive as possible by stopping frequently to ask questions and encourage class discussion.

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| Description: C:\Users\Mika\Documents\My Documents\Pearson\2012\June\8\Networking_Lesson6_Presentation_ROOT_060512\Slide1.JPG  This presentation describes the different network topologies and explains how they are used in peer-to-peer and client/server networks. | Presentation notes |
| Description: C:\Users\Mika\Documents\My Documents\Pearson\2012\June\8\Networking_Lesson6_Presentation_ROOT_060512\Slide2.JPG  It is helpful for a network administrator to know the pros and cons of different network topologies when putting together a network. By weighing the benefits of each type, the administrator can choose the configuration that is most efficient for the network's intended purpose. | Presentation notes |
| Description: C:\Users\Mika\Documents\My Documents\Pearson\2012\June\8\Networking_Lesson6_Presentation_ROOT_060512\Slide3.JPG  In a star topology, each computer is connected to a hub or switch. If a cable breaks, only the computer attached via that cable is affected and is isolated from the network. Stars are one of the more common topologies used today, used both in homes and in small and large businesses. All traffic that traverses the network passes through the central hub. The hub acts as a signal booster or repeater.  The star topology is considered the easiest topology to design and implement. An advantage of the star topology is the simplicity of adding additional nodes. The primary disadvantage of the star topology is that the hub represents a single point of failure.  Star topologies are very common, especially in Ethernet networks. Also, they are commonly mixed with one of the other topologies to create a hybrid topology. | Presentation notes |
| Description: C:\Users\Mika\Documents\My Documents\Pearson\2012\June\8\Networking_Lesson6_Presentation_ROOT_060512\Slide4.JPG  In a token ring network, computers are attached to a special kind of hub called an MAU, or multistation access unit. Inside the MAU, the computers are connected to each other in a ring formation. The network sends a token around the ring. Only one computer can hold the token at once, and computers are allowed to send information only when they hold the token. So, using the token prevents computers from sending signals at the same time and having those signals collide and interfere with each other. Each computer looks at the data being sent and picks it up only if it’s addressed to that computer. The computers ignore packets addressed to other computers.  The original IBM token ring used Type-1 shield cable, but later generations of token ring networks also support UTP cable as part of the IEEE 802.5 standard.  Some business networks still use ring formations, but these formations are no longer common on a LAN. A star formation using UTP cable is much more common, because the switches used in large networks are smarter at routing data to specific addresses. | Presentation notes |
| Description: C:\Users\Mika\Documents\My Documents\Pearson\2012\June\8\Networking_Lesson6_Presentation_ROOT_060512\Slide5.JPG  In a bus topology, every computer or node taps into a central cable that has a terminator at each end. Each computer claims any packets addressed to it and ignores packets addressed to other computers. It is easy to connect computers to a linear bus, and it requires less cable than a star topology.  However, if the central cable breaks, it divides the network into two separate sections. This gap will mean that computers on opposite sides of the break won’t be able to communicate. Also, if the entire network shuts down, it’s difficult to locate the problem.  Today, this type of network topology isn't used very often except on large-scale networks connecting many smaller networks. Even then, this is only a logical picture of what a bus topology looks like; bus topologies are almost never physically configured this way. | Presentation notes |
| Description: C:\Users\Mika\Documents\My Documents\Pearson\2012\June\8\Networking_Lesson6_Presentation_ROOT_060512\Slide6.JPG  In a mesh topology all nodes (for example, computers or other devices) are interconnected. A full mesh topology links every node to every other node on the network.  Full mesh topology has the highest fault tolerance of all of the network topologies, but it is also usually the most expensive and the most complex, because each connection needs its own cable. Every time you add a client to a mesh network you have to run cables to each of the other devices. If your network has four clients/devices, then you will need 6 cables. But if your network has 40 devices, you will need 780 cables. Also, troubleshooting to find the failed cable in such a network can be tricky. For these reasons, the full mesh topology is rarely used today.  However, the full mesh topology is sometimes used in a WAN environment because of its fault tolerance. Computers and other network devices can switch between the multiple redundant connections if the need arises. | Presentation notes |
| Description: C:\Users\Mika\Documents\My Documents\Pearson\2012\June\8\Networking_Lesson6_Presentation_ROOT_060512\Slide7.JPG  In a partial mesh topology, all computers can connect to all others by going through no more than a few nodes.  WAN implementations sometimes use a partial mesh to create a redundant point-to-point network connection between specific network devices. Using a partial mesh is a compromise between the need for fault tolerance and the cost of a full mesh. The same technology can be used with a partial mesh, but not all devices are interconnected. Deciding which devices have to be connected in order to ensure fault tolerance requires careful strategic planning. | Presentation notes |
| Description: C:\Users\Mika\Documents\My Documents\Pearson\2012\June\8\Networking_Lesson6_Presentation_ROOT_060512\Slide8.JPG  Stars, rings, buses, and mesh networks are the building blocks of network topologies. Many large networks use a combination of these techniques, linking smaller stars, rings, or buses into a larger network.  The image on this slide shows a small company’s network. The accounting department has three computers linked to a hub in a star formation. The Sales department also has three computers linked via a second hub, forming a second star topology. Then, the two hubs are connected in a bus topology to a central switch. This central line linking the two hubs could be called the network backbone, because each section of the network relies on that central cable. | Presentation notes |
| Description: C:\Users\Mika\Documents\My Documents\Pearson\2012\June\8\Networking_Lesson6_Presentation_ROOT_060512\Slide9.JPG  The ring, bus, star, and mesh topologies all describe networks by their shape. But networks can also be classified by the distances they cover.  Mostly we have discussed local area networks (LANs) so far. LANs are usually confined to a building or a few close buildings. They can be very small, like a home network, or connect hundreds of computers. LANs consist of laptop or desktop computers that might connect with a printer, fax machine, server, or other devices. LANs don’t have to be connected to the Internet, but many are.  Metropolitan area networks (MANs) connect multiple locations in one geographical region, such as a county or city. For example, your school is probably connected to a server in the central school district office, as are all the other schools. From there, the district has a line connecting all those computers to the Internet. A large business might have a warehouse, a factory, and an office all in the same city, so it connects through a MAN.  A wide area network (WAN) also connects many locations on one network. It can cross regional or national boundaries and might be used by a very large company that does business internationally. For example, a company might have factories in China, headquarters in the UK, and offices in the US, and all of their employees need to be able to communicate with each other.  Both MANs and WANs are used to connect multiple LANs. So, in each office or school, the users would use desktop computers in a local network, which is then connected to a MAN or a WAN. The Internet is the largest WAN of all. | Presentation notes |
| Description: C:\Users\Mika\Documents\My Documents\Pearson\2012\June\8\Networking_Lesson6_Presentation_ROOT_060512\Slide10.JPG  On a peer-to-peer (P2P) network, all computers have equal ability to communicate and control documents. All computers have the ability to work both as a client and as a server. All computers can share files with others, request files from other computers, and access office machines such as the fax machine or printer.  Since there isn’t a central computer controlling what the computers on a peer-to-peer network have access to, security is typically controlled by the end user. For example, if you own the desktop computer shown on the slide, it is your responsibility to configure who can see what on your local machine. | Presentation notes |
| Description: C:\Users\Mika\Documents\My Documents\Pearson\2012\June\8\Networking_Lesson6_Presentation_ROOT_060512\Slide11.JPG  In a client/server network, one computer is set up to function only as a server. The server controls the access that other computers have to shared resources such as documents, fax machines, and printers. Some servers are set up to perform multiple functions, while others perform only one particular task. For example, a web server might be responsible only for serving up a web page, while an email server allows employees to receive and send email.  The server can function on local, metropolitan, or wide area networks. On the local network, for example, it might function as a file server. In many businesses, employees’ work documents are saved to a folder that is stored and saved on a server machine. The folder has a shortcut on the worker’s desktop so that she can easily find the files. By saving files to the server, the network administrator can back up every document more easily. If the desktop computer crashes, the information will still be stored on the server. These employee folders might be password-protected so that other employees can’t access them, even though they are all working off of the same shared server.  The server might also store files for use on the Internet. When you go on the Internet and look up a web page, your computer requests the documents stored on a web server somewhere. If you load the *USA Today* news site, for example, the articles will be loaded from documents on servers that *USA Today* owns or leases. The servers answer your request by sending you the files, which are temporarily stored in your computer so that you can view them. | Presentation notes |
| Description: C:\Users\Mika\Documents\My Documents\Pearson\2012\June\8\Networking_Lesson6_Presentation_ROOT_060512\Slide12.JPG  Servers can be small computers or enormous racks of motherboards and hard drives. Here is an image of Google’s first production server.  Original caption courtesy photographer Steve Jurvetson:  Google’s First Production Server ... with the hair pulled back, revealing a rack of cheap networked PCs, circa 1999. Each level has a couple of PC boards slammed in there, partially overlapping. This approach reflects a presumption of rapid obsolescence of cheap hardware, which would not need to be repaired. Several of the PCs never worked, and the system design optimized around multiple computer failures. According to Larry and Sergey, the beta system used Duplo blocks for the chassis because generic brand plastic blocks were not rigid enough.  Image credit:  Jurvetson, Steve. “Google’s First Production Server.” Wikimedia Commons, <http://commons.wikimedia.org/wiki/File:Google%E2%80%99s_First_Production_Server.jpg> (accessed May 21, 2012). Image reproduced here under the terms of the Creative Commons Attribution 2.0 Generic license. | Presentation notes |
| Description: C:\Users\Mika\Documents\My Documents\Pearson\2012\June\8\Networking_Lesson6_Presentation_ROOT_060512\Slide13.JPG  There are lots of aspects to consider when building a network. You need to think about how the computers will be physically connected to each other, how much physical distance there is between the computers, and how the computers on the network will share resources. | Presentation notes |

Teacher Resource 6.2

Assessment Criteria:   
Presentation on Network Topologies

Student Names:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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Using the following criteria, assess whether the students met each one.

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|  |  | Met | Partially Met | Didn’t Meet |
| The agenda lists the important items for discussion. |  | □ | □ | □ |
| The diagram clearly and accurately illustrates the proposed network topology. |  | □ | □ | □ |
| The explanation of the diagram in the presentation is accurate. |  | □ | □ | □ |
| In the presentation, students clearly describe the advantages of the network being proposed. |  | □ | □ | □ |
| The presentation addresses scalability, or how the network might be expanded should the business continue growing. |  | □ | □ | □ |
| Visual and written materials are neat, with proper spelling and grammar. |  | □ | □ | □ |

Additional Comments:

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Teacher Resource 6.3

Key Vocabulary: Network Topologies

These are terms to be introduced or reinforced in this lesson.

| Term | Definition |
| --- | --- |
| bus | A network in which computers are connected to a backbone cable; each computer would connect to the backbone with a T-connector. |
| client | A computer requesting files from another machine (computer). |
| client/server network | A network where a server provides services to client computers, providing files, email, and web pages or controlling access to resources. |
| local area network (LAN) | A network used inside one building or location, connecting desktop computers and potentially printers, fax machines, and other office resources. |
| mesh | A network where many routers are interconnected to provide efficiency and reliability. This might occur in a multi-building WAN or out on the Internet. |
| metropolitan area network (MAN) | A network connected across more than one location in one city or region. |
| network node | Any device on the network that can be assigned an IP address, such as a computer, printer, or router. |
| peer | A client computer networked with other clients; computers engaging in file sharing with each other. |
| peer to peer | A network that connects client computers. Allows computers to share files with password protection. All users have the same levels of access and use the same passwords. |
| ring (token ring) | A token ring network connects computers in a formation resembling a star. However, the center hub has an internal ring. The network uses tokens to give computers access for sending information, so that only one computer can go at once. |
| server | A computer storing documents or controlling other computers’ access to files or resources such as printers, fax machines, and other computers. |
| star | A network where computers and other devices are connected via a hub or switch at the center. |
| topology | The “map” or physical layout of a network. |
| wide area network (WAN) | A network that crosses regional or national boundaries. |

Teacher Resource 6.4

Bibliography: Network Topologies

The following sources were used in the preparation of this lesson and may be useful to you as classroom resources. We check and update the URLs annually to ensure that they continue to be useful.

Print

Lowe, Doug. *Networking All-In-One Desk Reference for Dummies,* 2nd ed. Indianapolis, IN: Wiley, 2005.

Online

Jurvetson, Steve. “Image: Google’s First Production Server.” Wikimedia Commons, <http://commons.wikimedia.org/wiki/Image:Google’s_First_Production_Server.jpg> (accessed May 21, 2012).